



PULMONOLOGY

www.journalpulmonology.org



LETTER TO THE EDITOR

Embracing digital technology in chronic respiratory care: Surveying patients access and confidence

Dear Editor,

Pulmonary rehabilitation (PR) is an evidence-based intervention to improve symptoms, exercise capacity and quality of life of people with chronic respiratory diseases (CRD), such as those with chronic obstructive pulmonary disease (COPD) and asthma.¹ However, evidence from these specific CRD shows that these benefits diminish over time.^{2,3} Non-adherence to health-enhancing behaviours is one of the key factors associated with this decline.^{2,4} Therefore, novel approaches to promote long-term adherence and preserve the benefits gained are needed.

There is a growing evidence base for the use of internet/web-based approaches to support self-management and empowerment of patients with chronic diseases. Internet-based interventions have been shown to effectively improve health behaviours, such as physical activity.⁵ A web-based self-management program for patients with CRD may have the potential to be a novel and effective approach to support patients' long-term compliance with health-enhancing behaviours.⁵ However, few studies have evaluated the access to the internet or other digital technologies (e.g., smartphones) among patients with CRD, which are fundamental for the implementation of web-based approaches. The objective of this study was to explore if patients with CRD have access to digital technology and if they feel confident using it.

Patients with CRD were recruited from community-based PR programmes in seven healthcare centres of the centre region of Portugal, between October 2017 and September 2018. Inclusion criteria were having a diagnosis of CRD, at least 18 years old, and being referred by their general practitioner to a community-based PR programme. Exclusion criteria were history of a neoplastic/immunologic disease or presence of acute cardiac condition or a significant cardiac, musculoskeletal, neuromuscular or psychiatric condition. The study was approved by the Center Health Regional Administration (73/2016) and by the National Data Protection Committee (NDPC – 7295/2016).

All referred patients attended an initial visit at their primary healthcare centre, where they completed a structured questionnaire with the support of two trained

physiotherapists. Sociodemographic (age, sex, marital status, education and occupation), anthropometric and clinical (diagnosis, smoking habits, history of exacerbations and health resources use in the previous year) data were first obtained. Disability resulting from dyspnoea was also collected using the modified Medical Research Council questionnaire (mMRC).⁶ The primary outcome measures were access to technology and level of confidence in using it. Patients were surveyed regarding the use of internet; access to computers, smartphones (combination of mobile phone, web browser and computer capabilities)/tablets and cell phones (simple devices mainly for voice calls and text messages). Their level of confidence in using these technologies was assessed with two structured questions (*How confident do you feel using the internet? How confident do you feel using this device?*). Patients rated their confidence on a numerical scale from 0 (not at all confident) to 10 (completely confident) and were considered confident when a score of 6 or greater was selected. A previous study showed a mean of 6 represented confidence in computer experience.⁷ All data, collected after obtaining the informed consent of patients, were anonymised and processed in bulk according to the requirements of the NDPC and to comply with the General Data Protection Regulation. Descriptive statistics were used to describe the sample. Chi-square tests for categorical data or independent t-tests for continuous data were used to explore if access to digital technology was related to patients' characteristics. Variables that were statistically different were used as independent variables in one multivariate logistic regression using the Stepwise method. The overall model was evaluated using the Nagelkerke's R-square.

A total of 141 patients were enrolled, with a mean age of 66.5 ± 11.4 [21–88] (Table 1). Patients were mostly married (73.1%) and almost half had only completed primary school (48.9%) (Table 1). COPD ($n=84$; 59.6%) and asthma ($n=26$; 18.4%) were the most common diagnosis (Table 1). A total of 115 (81.6%) patients reported having access to digital technology: 62 (44%) used the smartphone or tablet, 53 (37.6%) used the computer and 52 (36.9%) the cell phone. 81% of patients reported themselves to be confident using these technologies (median 7, interquartile range 5–9.5). Median confidence was similar across the distinct technologies (Fig. 1). More than half of the patients ($n=75$; 53.2%) used the internet and, from these, 85% felt confident in using it (median 8, interquartile range 5.75–10) (Fig. 1).

<https://doi.org/10.1016/j.pulmoe.2019.05.001>

2531-0437/© 2019 Sociedade Portuguesa de Pneumologia. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Please cite this article in press as: Jácome C, et al. Embracing digital technology in chronic respiratory care: Surveying patients access and confidence. Pulmonol. 2019. <https://doi.org/10.1016/j.pulmoe.2019.05.001>

Table 1 Characteristics of the participants (*n* = 141).

	Total (<i>n</i> = 141)	No access to internet (<i>n</i> = 66)	Access to internet (<i>n</i> = 75)	<i>p</i> -value
<i>Male, n (%)</i>	86 (61%)	42 (63.6%)	44 (58.7%)	0.612
<i>Age</i>	66.5 ± 11.4 (21–88)	71.3 ± 7.8 (51–88)	62.2 ± 12.4 (21–80)	<0.001
<i>Marital/Civil status, n (%)</i>				
Married/Civil union	103 (73.1%)	49 (74.3%)	54 (72%)	0.010
Divorced	16 (11.3%)	5 (7.6%)	11 (14.7%)	
Singled	12 (8.5%)	3 (4.5%)	9 (12%)	
Widowed	10 (7.1%)	9 (13.6%)	1 (1.3%)	
<i>Education, n (%)</i>				
No education	7 (5%)	6 (9.1%)	1 (1.3%)	<0.001
Primary school	69 (48.9%)	47 (71.3%)	22 (29.3%)	
Elementary school	27 (19.2%)	10 (15.1%)	17 (22.7%)	
High school	23 (16.3%)	3 (4.5%)	20 (26.7%)	
University	15 (10.6%)	0	15 (20%)	
<i>Occupation, n (%)</i>				
Retired	98 (69.5%)	57 (86.4%)	41 (54.7%)	<0.001
Employed	26 (18.5%)	4 (6.1%)	22 (29.4%)	
Unemployed	16 (11.3%)	5 (7.5%)	11 (14.6%)	
Student	1 (0.7%)	0	1 (1.3%)	
<i>BMI, kg/m²</i>	27.1 ± 5.2 (17.1–38.2)	27.3 ± 5. (17.1–38.2)	26.9 ± 5.1 (17.9–37.4)	0.613
<i>Smoking status, n (%)</i>				
Ex-smoker	70 (49.6%)	30 (45.5%)	40 (53.4%)	0.163
Never smoker	51 (36.2%)	29 (43.9%)	22 (29.3%)	
Current smoker	20 (14.2%)	7 (10.6%)	13 (17.3%)	
<i>mMRC, Median [IQR]</i>	2 [1, 3]	2 [1, 3]	1 [1, 2]	0.008
<i>Diagnosis, n (%)</i>				
COPD	83 (58.9%)	42 (63.6%)	41 (54.7%)	0.109
Asthma	26 (18.4%)	14 (21.2%)	12 (16%)	
ACOS	13 (9.2%)	6 (9.1%)	7 (9.3%)	
Others	19 (13.5%)	4 (6.1%)	15 (20%)	
<i>Exacerbations past year, n (%)</i>				
0	62 (44%)	29 (43.9%)	33 (44%)	0.197
1–2	55 (39%)	29 (43.9%)	26 (34.7%)	
≥3	24 (17%)	8 (12.1%)	16 (21.3%)	
At least 1 emergency department visit past year, <i>n (%)</i>	42 (29.8%)	19 (28.8%)	23 (30.1%)	0.734
At least 1 hospital admission past year, <i>n (%)</i>	36 (25.5%)	18 (27.3%)	18 (24%)	0.618

Abbreviations: BMI, body mass index; COPD, chronic obstructive pulmonary disease; mMRC, modified Medical Research Council Dyspnoea Scale; ACOS, Asthma COPD Overlap Syndrome. Data are presented as mean ± SD (range) or *n* (%), unless otherwise indicated.

Patients with access to the internet were younger ($p < 0.001$), were mostly married or single/divorced ($p = 0.010$), had higher levels of education ($p < 0.001$); were mostly of active age (employed, unemployed, student) and had lower mMRC scores ($p = 0.008$). Lower age (odds ratio – OR = .935; 95% confidence interval – 95%CI .889–.982) and a higher level of education (OR = 3.633; 95%CI 2.093–6.307) increased the likelihood of using the internet. This logistic regression model was statistically significant ($\chi^2(2) = 59.67$,

$p < 0.001$) and explained 46% (Nagelkerke R^2) of the variance in internet use.

Most patients had access to digital technologies: more than 1/3 used the internet or computer and almost half used a smartphone/tablet. Similar data (i.e., 33% used the internet daily, 44% had a computer and 41% a smartphone), have been reported in a European study about patients' preference for using technologies to participate in COPD clinical trials.⁸ In the United States, 40.2% of the elderly have access

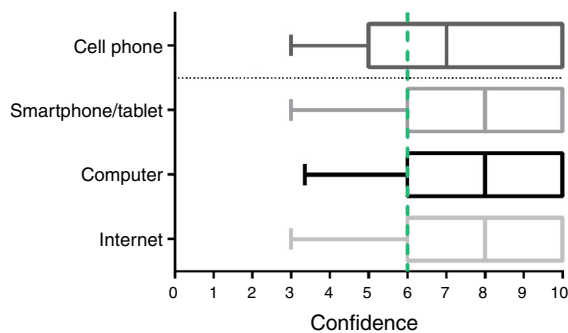


Figure 1 Patients confidence in using digital technologies. Data are presented as box plots (lines inside the boxes represent the medians; bounds of boxes, first and third quartiles; bars, 95% confidence interval).

to a computer and 39.9% to the internet.⁹ However, confidence in using digital technologies was lower (computer 36.1%; internet 29.9%; tablet 22.1%).⁹ Nevertheless, the patients enrolled were older than the ones included in the present study, and a different data collection method (10-point numerical scale vs. 5-point Likert-scale) was used.⁹ Younger patients and those with higher levels of education were most likely to use the internet. A previous study with 512 patients recruited in primary healthcare also found that internet use was associated with age less than 60 years, college education and household income level.¹⁰ This study has some limitations. Our sample was mainly composed of patients with COPD and asthma recruited from Portuguese primary healthcare centres, hindering the generalisation of our findings to all CRD, healthcare settings and different countries. In addition, we assessed both access and confidence using patients' self-report, which may reflect bias in reporting. Future studies with larger samples of subjects with distinct CRD recruited from primary and secondary care centres should be conducted combining subjective and objective data.

This study shows that patients with CRD from the community, namely those with COPD and asthma, have access to and feel confident using digital technologies. These results reinforce the potential of using digital technologies as a resource for self-management/maintenance strategies in this population.

Funding

This work is integrated in the project Revitalizing Pulmonary Rehabilitation (3R), SAICT-POL/23926/2016, was funded by Fundo Europeu de Desenvolvimento Regional (FEDER) – Comissão Diretiva do Programa Operacional Regional do Centro and by Fundação para a Ciência e Tecnologia (FCT) and partially funded by Programa Operacional Competitividade e Internacionalização (COMPETE), through COMPETE 2020 (POCI-01-0145-FEDER-016701) and FCT (UID/BIM/04501/2013, UID/BIM/04501/2019, and POCI-01-0145-FEDER-007628-iBIMED). CJ is a pos-doc fellow (SFRH/BPD/115169/2016) funded by Fundação para a Ciência e Tecnologia (FCT), reimbursed by Fundo Social Europeu and by national funds of MCTES.

Conflicts of interest

None.

Acknowledgments

We would like to acknowledge the primary healthcare centres involved (Unidade de Saúde Familiar (USF) Marquês de Marialva, Unidade de Cuidados de Saúde Personalizados (UCSP) Mira, Unidade de Cuidados na Comunidade (UCC) Cubo Mágico, Unidades do Centro de Saúde de Agueda, Unidades do Centro de Saúde de Aveiro, UCSP Estarreja).

References

1. Spruit MA, Singh SJ, Garvey C, ZuWallack R, Nici L, Rochester C, et al. An Official American Thoracic Society/European Respiratory Society statement: key concepts and advances in pulmonary rehabilitation. *Am J Respir Crit Care Med*. 2013;188:e13–64.
2. Griffiths TL, Burr ML, Campbell IA, Lewis-Jenkins V, Mullins J, Shiels K, et al. Results at 1 year of outpatient multidisciplinary pulmonary rehabilitation: a randomised controlled trial. *Lancet*. 2000;355:362–8.
3. Jácome C, Marques A. Short- and long-term effects of pulmonary rehabilitation in patients with mild COPD: a comparison with patients with moderate-to-severe COPD. *J Cardiopulm Rehabil Prev*. 2016;36:445–53.
4. Brooks D, Krip B, Mangovski-Alzamora S, Goldstein RS. The effect of postrehabilitation programmes among individuals with chronic obstructive pulmonary disease. *Eur Respir J*. 2002;20:20–9.
5. van der Weegen S, Verwey R, Spreeuwenberg M, Tange H, van der Weijden T, de Witte L. It's LiFe! Mobile and web-based monitoring and feedback tool embedded in primary care increases physical activity: a cluster randomized controlled trial. *J Med Internet Res*. 2015;17:e184.
6. GOLD. Global strategy for diagnosis, management, and prevention of chronic obstructive pulmonary disease 2019. The Global Initiative for Chronic Obstructive Lung Disease; 2019. Available from: <http://goldcopd.org/> [February 2019].
7. Hasan B. The influence of specific computer experiences on computer self-efficacy beliefs. *Comput Hum Behav*. 2003;19:443–50.
8. Khurana L, Durand EM, Gary ST, Otero AV, Hall C, Berry K, et al. Patient preference for using computers, smartphones, and internet to participate in COPD clinical trials. *Eur Respir J*. 2016;48 Suppl. 60. PA2899.
9. Abrashkin KA, Patel V, Kozikowski A, Zhang M, Poku A, Pekmezaris R. Access to and confidence in using technology among homebound older adults and caregivers. *J Am Med Dir Assoc*. 2018;19:1023–4.
10. Diaz JA, Griffith RA, Ng JJ, Reinert SE, Friedmann PD, Moulton AW. Patients' use of the Internet for medical information. *J Gen Intern Med*. 2002;17:180–5.

C. Jácome^{a,b,*}, F. Marques^{c,d}, C. Paixão^{b,e}, P. Rebelo^{b,e}, A. Oliveira^{b,e}, J. Cruz^{b,f}, C. Freitas^a, M. Rua^g, H. Loureiro^e, C. Peguinho^h, A. Simõesⁱ, M. Santos^j, C. Valente^k, P. Simão^l, A. Marques^{b,e}

^a *CINTESIS – Center for Health Technology and Services Research, Faculty of Medicine, University of Porto, Porto, Portugal*

^b *Lab 3R – Respiratory Research and Rehabilitation Laboratory, School of Health Sciences, University of Aveiro (ESSUA), Aveiro, Portugal*

^c *ESTGA – Águeda School of Technology and Management, Águeda, Portugal*

^d *IEETA – Institute of Electronics and Informatics Engineering of Aveiro, Aveiro, Portugal*

^e *Institute of Biomedicine (iBiMED), University of Aveiro, Aveiro, Portugal*

^f *School of Health Sciences (ESSLei), Center for Innovative Care and Health Technology (ciTechCare), Polytechnic Institute of Leiria, Leiria, Portugal*

^g *Research Centre on Didactics and Technology in the Education of Trainers – CIDTFF, Aveiro, Portugal*

^h *Institute of Accounting and Administration, University of Aveiro (ISCA-UA), Aveiro, Portugal*

ⁱ *Câmara Municipal de Aveiro, Aveiro, Portugal*

^j *Câmara Municipal de Mira, Mira, Portugal*

^k *Pulmonology Department, Centro Hospitalar do Baixo Vouga, Aveiro, Portugal*

^l *Pulmonology Department, Unidade Local de Saúde de Matosinhos, Matosinhos, Portugal*

* Corresponding author.

E-mail address: cristinajacome.ft@gmail.com (C. Jácome).